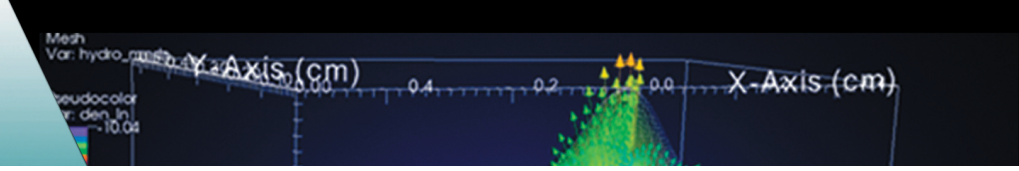
Great Science

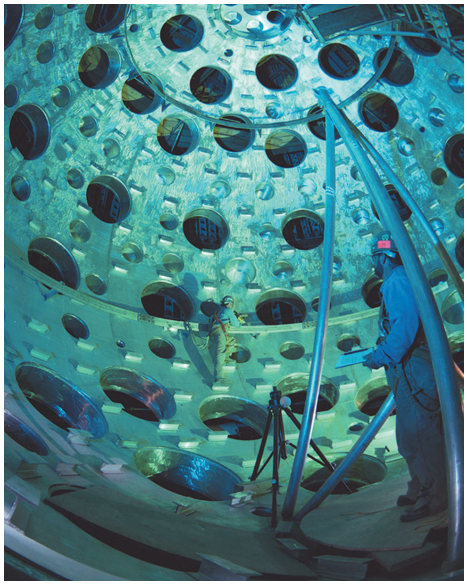


"From the first experiments on the National Ignition Facility … to new biological agent sensor systems and radiation detectors, the Laboratory's science and technology are strengthening national and homeland security. Major advances in supercomputing are improving our abilities to sustain a safe and effective nuclear deterrent while they are creating wide-ranging opportunities for scientific discovery."

Mike Anastasio LLNL Director

National Ignition Facility (NIF)

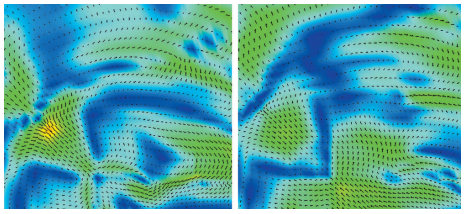
In May 2003, NIF set a world record for laser performance, producing 10.4 kiloJoules (kJ) of ultraviolet light in a single laser beamline. This was accomplished using only a fraction of NIF's ultimate capacity. As a unique inertial confinement fusion facility, NIF accesses regimes of extreme pressures and temperatures, for the Stockpile Stewardship Program. Computer scientists develop control system software, diagnostic tools, simulation codes, and database applications in support of NIF.



The 10-meter-diameter target chamber of the National Ignition Facility was assembled from 18 aluminum sections, each 10 centimeters thick. It is located in a 7-story target bay, weighs about 450,000 kilograms, and has been precision-aligned to better than 1-millimeter accuracy.

Scientific Computing

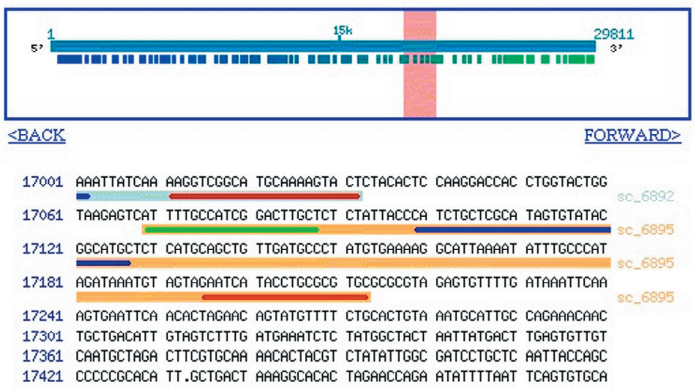
New algorithms facilitated the largest-ever ALE3D calculations in 2003. Used for large 3D structural dynamics simulations, this code solved for 610 million unknowns, using 4,032 processors on the ASC White supercomputer. This calculation is 100 times larger than the simulations of just four years ago, while using only 10 times the number of processors. Other computer scientists work with physicists to develop simulation codes that model weapons, stellar evolution, and other physical phenomena. They also develop the tools to visualize the terabytes of data generated by such research.



Two visualizations of conditions about eight minutes apart simulate the changes inside the core of a star four times the mass of our Sun. Colors represent relative velocities (increasing from blue to yellow), and arrows indicate the direction of convection currents.

Biodefense

In collaboration with biologists in the field, LLNL computer scientists pioneered the computational design of DNA signatures for the detection of bioterrorism or natural disease outbreaks. Our DNA signature pipeline is a fully automated software system for identifying unique regions on pathogen genomes, and selecting optimal sequences for development of real-time detection assays. In close collaboration with the Centers for Disease Control we provided signature design expertise, which resulted in successful assays for smallpox, monkeypox, and SARS — all in response to unplanned world events.



Example of a SARS Genome – The top bar is a representation of the entire SARS (Sudden Acute Respiratory Syndrome) genome of 29,811 nucleotides. The pink block highlights an area seen in expanded view, which represents each nucleotide as a letter. Colored lines below some of the letters identify portions of the sequence that are unique to SARS — the SARS signature.

http://www.llnl.gov/comp/opportunities/

Work performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory, under Contract No. W-7405-ENG-48. UCRL –MI-207898-06